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JC07 Rec'd PCT/PTO 07 FEB 2002

FORM PTO-1390 (REV. 12-2001) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY 'S DOCKET NUMBER	U.S. APPLICATION NO. (If known, see 37 CFR 1.5
NOR-1043	10/049165

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/EP00/05843	24 June 2000	10 August 1999

TITLE OF INVENTION: METHOD AND DEVICE FOR PRODUCING A REMOVABLE PROTECTION LAYER FOR SURFACES, ESPECIALLY VARNISHED SURFACES OF MOTOR VEHICLE BODIES

APPLICANT(S) FOR DO/EO/US: KONRAD ZINNERMANN AND KLAUS PETER REINKE

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [XX] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. [ ] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. [ ] This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. [XX] The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. [XX] A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. [XX] is attached hereto (required only if not communicated by the International Bureau).
   b. [ ] has been communicated by the International Bureau.
   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US).
6. [ ] An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. [ ] is attached hereto.
   b. [ ] has been previously submitted under 35 U.S.C. 154(d)(4).
7. [ ] Amendments to the claims of the International Aplication under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [ ] are attached hereto (required only if not communicated by the International Bureau).
   b. [ ] have been communicated by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [ ] have not been made and will not be made.
8. [ ] An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. [XX] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). (unexecuted).
10. [ ] An English lanugage translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. [ ] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. [ ] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. [XX] A FIRST preliminary amendment. is forthcoming.
14. [ ] A SECOND or SUBSEQUENT preliminary amendment.
15. [ ] A substitute specification.
16. [ ] A change of power of attorney and/or address letter.
17. [ ] A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18. [ ] A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. [ ] A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. [ ] Other items or information:

U.S. APPLICATION NO. (if known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
10/049165	PCT/EP00/05843	NOR-1043

21. ☒ The following fees are submitted:

	CALCULATIONS PTO USE ONLY
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):	
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO **$1040.00**	
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO **$890.00**	
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO **$740.00**	
International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) **$710.00**	
International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) **$100.00**	
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 890.00
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☒ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$ 130.00

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total claims	22 - 20 =	2	x $18.00	$ deferred
Independent claims	2 - 3 =	0	x $84.00	$
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ $280.00	$ deferred
TOTAL OF ABOVE CALCULATIONS =				$
☐ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2. +				$
SUBTOTAL =				$ 1020.00
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☒ 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				$ 130.00
TOTAL NATIONAL FEE =				$ 1150.00
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$
TOTAL FEES ENCLOSED =				$ 1150.00
			Amount to be refunded:	$
			charged:	$

a. ☒ A check in the amount of $ 1150.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of $ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 23-3000. A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

WOOD, HERRON & EVANS, L.L.P.
441 VINE STREET
2700 CAREW TOWER
CINCINNATI, OH 45202

SIGNATURE 2/7/02

Kevin G. Rooney
NAME

36,330
REGISTRATION NUMBER

~~5030~~ 5000

PCT

PATENT

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231 on June 6, 2002

William R. Allen

William R. Allen, Reg. No. 48,389

6 June 2002

Date

Applicants:	Konrad Zimmerman et al.
Serial No:	10/049,165
Filing Date:	February 7, 2002
Art Unit:	Unknown
Title:	APPARATUS AND METHODS FOR DISPENSING A COATING MATERIAL (As Amended)
Atty Docket:	NOR-1043

Cincinnati, Ohio 45202 June 6, 2002

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to examination, please preliminarily amend this application as follows:

IN THE TITLE:

Change the Title from "Method for Dispensing Fluid, Especially Glue" to

--Apparatus and Methods for Dispensing a Coating Material--.

IN THE SPECIFICATION:

Please substitute the attached Substitute Specification for the translation of the German language specification filed as the original specification with this application.

IN THE CLAIMS:

Please cancel claims 1-22.

Please add new claims 23-42 as follows:

23. (NEW) A device for placing a curable liquid coating material onto a surface to produce a peel-off protective layer, comprising

a spray nozzle adapted to spray the curable liquid coating material onto an area of the surface, said spray nozzle and the surface being movable relative to each other; and

a first applicator nozzle positioned adjacent to said spray nozzle, said first applicator nozzle and the surface being movable relative to each other, and said first applicator nozzle adapted to apply the curable liquid coating material onto the surface adjacent to a lateral edge of said area.

24. (NEW) The device of claim 23 further comprising:

a frame carrying said spray nozzle and said applicator nozzle; and

a robot arm carrying said frame, said robot arm movable relative to the surface for moving said spray nozzle and said applicator nozzle relative to the surface.

25. (NEW) The device of claim 23 further comprising:

a first coating material line supplying the curable liquid coating material to said spray nozzle; and

a second coating material line supplying the curable liquid coating material to said applicator nozzle.

26. (NEW) The device of claim 25 further comprising:

a first automatic pressure controller coupled in fluid communication with said first coating material line; and

a second automatic pressure controller coupled in fluid communication with said second coating material line, said first and said second automatic pressure controllers being adapted to adjust the pressure of the curable liquid coating material in the corresponding one of said first and said second coating material lines.

27. (NEW) The device of claim 23 further comprising:

a light source emitting a beam of light;

an optical sensor operative to detect the beam of light emitted by the light source and to generate a signal representative of the intensity of the incident light; and

a control unit electrically coupled with said optical sensor, said control unit adapted to evaluate the signal generated by said optical sensor so as to monitor the spraying and applying of the curable liquid coating material.

28. (NEW) The device of claim 23 further comprising a heating device capable of heating the curable liquid coating material being provided to said spray nozzle and said applicator nozzle.

29. (NEW) The device of claim 23 wherein said applicator nozzle is positionable relative to said spray nozzle for adjusting a position of the application of the curable liquid coating material relative to a position of the spray of the curable liquid coating material.

30. (NEW) A method of applying a peel-off protective layer to a surface, comprising:

spraying a first curable liquid coating material onto an area of the surface;

applying a second curable liquid coating material onto the surface adjacent to a lateral edge of the area; and

curing the first and the second curable liquid coating materials to provide the peel-off protective layer.

31. (NEW) The method of claim 30 wherein the second curable liquid material is applied with an applicator nozzle, and the applying of the second curable liquid coating material further includes discharging a flat strip of the second curable liquid coating material such that the width of the strip increases with increasing distance from the applicator nozzle.

32. (NEW) The method of claim 30 further comprising applying a second curable liquid coating material onto the surface adjacent to a different lateral edge of the area.

33. (NEW) The method of claim 30 wherein the spraying of the first curable liquid coating material includes directing individual sprays from each of a plurality of adjacent spray nozzles to the area of the surface in an overlapping fashion.

34. (NEW) The method of claim 30 wherein the first and the second curable liquid coating materials have identical compositions, and further comprising providing the first and the second curable liquid coating materials for spraying and applying, respectively, in individual coating material streams from a common coating material source.

35. (NEW) The method of claim 34 further comprising adjusting at least one of the pressure and the flow rate of each of the individual coating material streams.

36. (NEW) The method of claim 34 further comprising automatically controlling at least one of the pressure and the flow rate of each of the individual coating material streams.

37. (NEW) The method of claim 30 further comprising heating the first and the second curable liquid coating materials to a desired temperature.

38. (NEW) The method of claim 30 wherein the first and the second curable liquid coating materials are water-based, and the curing of the first and the second curable liquid coating materials includes evaporating water from the first and the second curable liquid coating materials to provide the peel-off protective layer.

39. (NEW) The method of claim 30 further comprising monitoring the spraying of the first and the applying of the second curable liquid coating materials with an optical sensor.

40. (NEW) The method of claim 30 wherein the spraying of the first curable liquid coating material onto the area occurs before the application of the second curable liquid coating material to the lateral edge of the area.

41. (NEW) The method of claim 30 wherein the spraying of the first curable liquid coating material includes directing multiple parallel swathes of the first liquid curable coating material onto the area of the surface.

42. (NEW) The method of claim 30 wherein the first curable liquid coating material is sprayed from a spray nozzle and the second curable liquid coating material is applied from an applicator nozzle, and further comprising moving the spray nozzle and the applicator nozzle along respective preprogrammable paths relative to the surface during the steps of spraying and applying.

REMARKS

By this Preliminary Amendment, the specification has been replaced by a Substitute Specification. In addition, claims 1-22 have been cancelled and claims 23-42 are added.

The Substitute Specification is based on the translation of the German language specification and the Examiner has been provided with a marked-up copy of the Substitute Specification in accordance with MPEP § 608.01(q). The marked-up copy shows deletions from the translation in brackets and insertions into the translation underlined. The amendments have been made to conform the specification to U.S. format and to correct typographical errors. It is respectfully submitted that no "new matter" has been added by this substitute specification and confirmation of this through entry of the substitute specification by the Examiner would be appreciated.

Applicants do not believe that any fees are due in connection with this submission. However, if such petition is due or any fees are necessary, the Commissioner may consider this to be a request for such and charge any necessary fees to deposit account 23-3000.

Early and favorable consideration of this application is respectfully requested.

Respectfully submitted,

WOOD, HERRON & EVANS L.L.P.

William R Allen

William R. Allen, Ph.D.
Reg. No. 48,389

2700 Carew Tower
Cincinnati, OH 45202
(513) 241-2324

10049165 10/049165
13 August 2002

PATENT

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231 on June 6, 2002

William R. Allen

William R. Allen, Reg. No. 48,389

6 June 2002

Date

Applicants:	Konrad Zimmerman et al.
Serial No:	10/049,165
Filing Date:	February 7, 2002
Art Unit:	Unknown
Title:	APPARATUS AND METHODS FOR DISPENSING A COATING MATERIAL (As Amended)
Atty Docket:	NOR-1043

Cincinnati, Ohio 45202 June 6, 2002

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a first applicator nozzle positioned adjacent to said spray nozzle, said first applicator nozzle and the surface being movable relative to each other, and said first applicator nozzle adapted to apply the curable liquid coating material onto the surface adjacent to a lateral edge of said area.

24. (NEW) The device of claim 23 further comprising:

a frame carrying said spray nozzle and said applicator nozzle; and

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a light source emitting a beam of light;

an optical sensor operative to detect the beam of light emitted by the light source and to generate a signal representative of the intensity of the incident light; and

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31. (NEW) The method of claim 30 wherein the second curable liquid material is applied with an applicator nozzle, and the applying of the second curable liquid coating material further includes discharging a flat strip of the second curable liquid coating material such that the width of the strip increases with increasing distance from the applicator nozzle.

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35. (NEW) The method of claim 34 further comprising adjusting at least one of the pressure and the flow rate of each of the individual coating material streams.

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Respectfully submitted,

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2700 Carew Tower
Cincinnati, OH 45202
(513) 241-2324

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5000

PATENT

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William R Allen
William R. Allen, Reg. No. 48,389

6 June 2002
Date

Applicants:	Konrad Zimmerman and Klaus Peter Reinke
Serial No.:	10/049,165
Filed:	February 7, 2002
Art Unit:	Unknown
Examiner:	Unknown
Title:	METHOD AND DEVICE FOR PRODUCING A REMOVABLE PROTECTING LAYER TO SURFACES ESPECIALLY VARNISHED SURFACES OF MOTOR VEHICLE BODIES
Atty Docket No.:	NOR-1043

Cincinnati, Ohio 45202 June 6, 2002

SUBMISSION OF FORMAL DRAWING

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Applicants submit herewith one (1) sheet of formal drawings. Please substitute this formal drawing for the informal drawing originally filed with the above-identified application.

Applicants do not believe that any fees are due in connection with this submission. However, if such petition is due or any fees are necessary, the

Commissioner may consider this to be a request for such and charge any necessary fees to deposit account 23-3000.

Respectfully submitted,

WOOD, HERRON & EVANS, L.L.P

William R Allen

William R. Allen
Reg. No. 48,389

2700 Carew Tower
441 Vine Street
Cincinnati, OH 45202
(513) 241-2324
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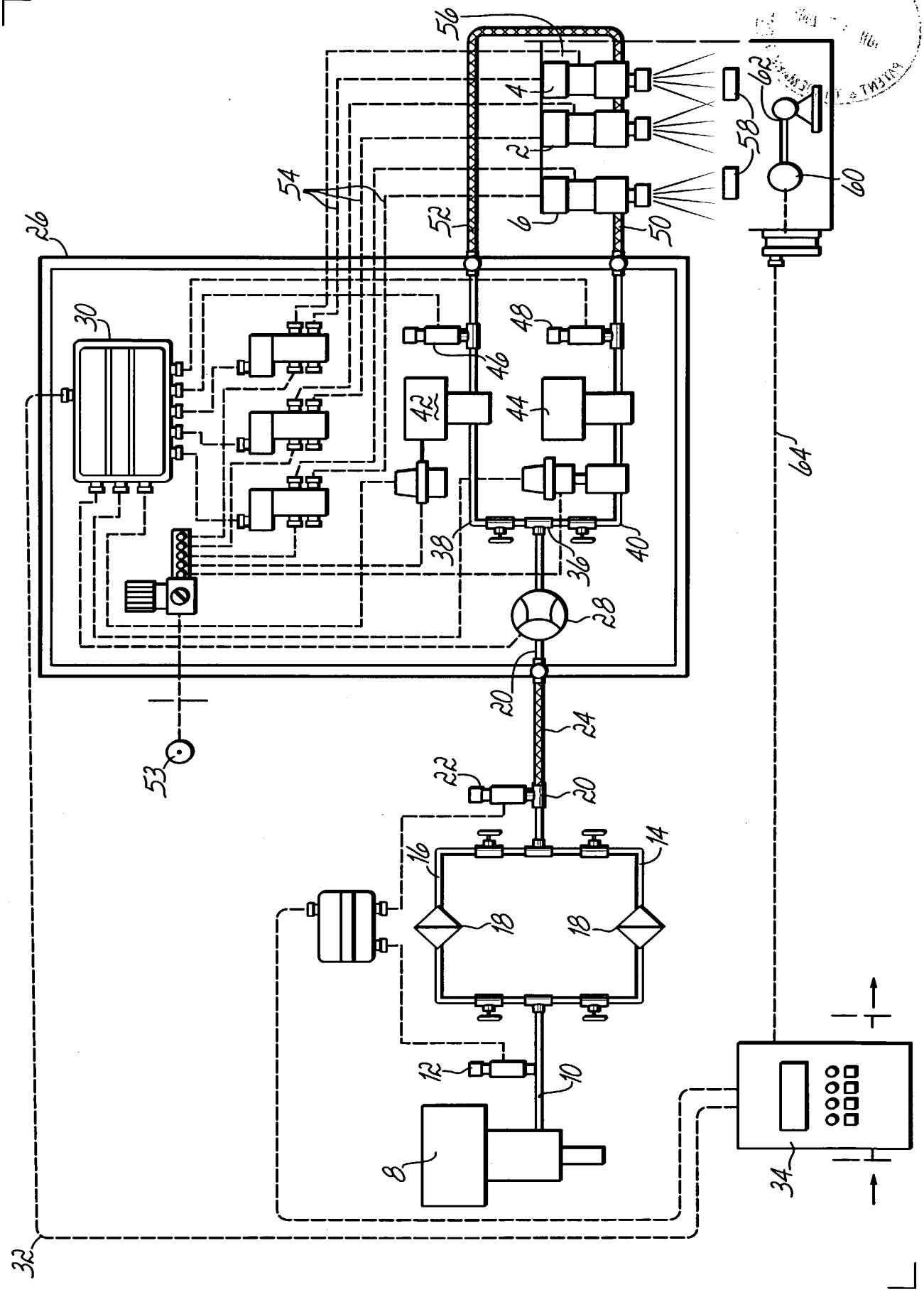
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PROCESS AND DEVICE FOR PRODUCING A PEEL-OFF PROTECTIVE LAYER FOR SURFACES, ESPECIALLY THE PAINTED SURFACES OF MOTOR VEHICLE BODIES

Field of the Invention

The present invention pertains to a process and a device for producing a peel-off protective layer for surfaces, especially the painted surfaces of motor vehicle bodies, in which a curable liquid coating material is sprayed from a spray nozzle onto the surface to be protected and forms there a two-dimensional protective layer[, which then cures] when cured.

[The invention also pertains to a device for producing a peel-off protective layer for surfaces, especially the painted surfaces of motor vehicle bodies, with a spray nozzle, which can be supplied with liquid coating material from a coating material source, so that a curable liquid coating material can be sprayed onto the surface to be protected, where the spray nozzle and the surface can be moved relative to each other.]

[A process and a device of this type known from DE 196-52,728 A1 are used primarily to produce peel-off] Peel-off protective layers are placed on the painted surfaces of motor vehicles to protect them from environmental influences such as dirt and intense sunlight, especially during transport from the motor vehicle manufacturer and until the time of delivery to the customer. The protective layer is [thus] produced at the manufacturer's plant by the application

of a liquid to the painted surface of a motor vehicle, and then this liquid is cured or solidified. The liquid can be an aqueous dispersion from which the water evaporates during curing, so that a kind of peel-off film is formed on the surface. The film thus produced can then be peeled off by hand before the vehicle is delivered to the buyer.

A significant disadvantage of [the know process] conventional processes is that, because the liquid coating material is sprayed on, it is impossible to obtain a sharp contour at the edges of the sprayed-on areas of coating material; instead, individual particles or droplets are formed in the edge areas, which are separate and detached from the continuous protective layer ("overspray"). A protective layer in the form of individual particles does not offer sufficient protection to the paint after curing and also makes it almost impossible for the cured protective layer to be gripped by hand so that it can be peeled off. The individual particles, furthermore, must be removed manually or by some other labor-intensive means.

[The task of the present invention is to provide] For these and other reasons, it would be desirable to provide a process and a device [of the general type indicated above by means of which] for producing a sharply contoured protective layer [can be easily produced, especially for] on a surface, such as the painted surfaces of motor vehicle bodies.

Brief Summary of the Invention

The invention [accomplishes this task in] is directed to a process [of the general type indicated above] in [that] which coating material [which] emerges essentially as a continuous strand or strip of material from an applicator nozzle

and is applied to the surface to be coated at the edges of the areas which have been sprayed with the coating material.

The invention is further directed to [also accomplishes its task with] a device [of the general type indicated above by means of] having at least one applicator nozzle for the application of coating material as an essentially continuous strand or strip of material to the surface to be coated.

The process according to the invention and the device according to the invention make it possible to produce a protective layer for surfaces [which has a] having sharply defined lateral [edge] edges and thus a defined size. Because a continuous or nearly continuous strand or strip of material is applied to the edge areas of the sprayed-on coating material, a clean, sharply contoured edge is formed, without the occurrence of individual particles or droplets (overspray), which then cure on the surface. The sharply contoured, overspray-free edge can, after it has cured, be gripped easily by hand and lifted, and the protective layer thus produced can then be easily peeled off. According to the invention, a relatively large area is coated by spraying on the coating material, whereas, during or after the spraying step, an applicator nozzle which produces an essentially continuous strand or strip of material is used to produce a sharp-edged, overspray-free coating in the area of the outer edges of the sprayed-on coating, where individual sprayed-on liquid particles can be scattered.

According to an especially preferred embodiment of the process according to the invention, it is provided that the protective layer sprayed on by [means of] the spray nozzle and the protective layer applied by [means of] the applicator nozzle consist of the same coating material and coalesce to form a

single protective layer on the surface before they have cured. The viscosity of the coating material, which is essentially a function of temperature, is selected so that the coating material sprayed on by the spray nozzle and the coating material applied by the applicator nozzle flow into each other and form a single layer. The sprayed-on particles in the edge area coalesce completely with the coating material which has been applied as an essentially continuous strand or strip of material.

According to an elaboration of the process according to the invention, it is proposed that the protective layer sprayed on by the spray nozzle and the protective layer applied by the applicator nozzle have a thickness such that a protective layer is formed which, in the completely cured state, forms a completely closed protective layer which is essentially impermeable to water, gas, and dust and which can be peeled off by hand. A protective layer of this type is liquid-repellent, but does not usually dissolve upon contact with water and provides reliable protection during transport.

An especially preferred alternative embodiment of the process according to the invention is characterized in that the coating material emerges from the applicator nozzle as a flat strip of material which expands as its distance from the applicator nozzle increases. A flat strip of material of this type can be laid onto the surface in a defined manner at the edges of the previously or simultaneously sprayed-on coating. In the cured state, the protective layer can then be gripped by hand at this edge and peeled off without causing the protective layer to tear. For example, a slit nozzle or a specially designed nozzle with an essentially rectangular discharge opening could be used.

According to an alternative embodiment, it is provided that several

strands or strips of material are applied from several applicator nozzles to the edge areas of the coating material sprayed onto the surface. In this way, a relatively wide overspray area can be covered with coating material.

To obtain a protective layer with a large surface area, it is provided that the coating material is sprayed on in an overlapping manner by means of several adjacent spray nozzles. The degree of overlap can be varied; it depends on the pressure of the coating material in the feed line and on the distance between the individual spray nozzles.

Another elaboration of the invention is characterized in that the spray nozzle and the applicator nozzle are fed from a common coating material source but by two coating material streams which are at least partially separate from each other. Because of the use of two separate coating material streams, it is possible for the pressure in one of the feed lines to be different from that in the other. The pressure of the coating material in the feed line to the spray nozzle will usually be much higher than the pressure in the coating material feed line to the applicator nozzle. In addition, the coating material can be supplied to the spray nozzle and to the applicator nozzle in alternation; in most cases, according to a preferred embodiment described in greater detail further below, the material will first be sprayed on over a wide area, and then a sharply contoured edge will be produced at the edge areas by means of the applicator nozzle.

According to a further elaboration of the process, it is provided that the pressures in the separate coating material streams leading to the applicator nozzle and to the spray nozzle are adjustable or controllable. The flow rates, measured either by weight or volume, of the separate coating material streams

being supplied to the applicator nozzle and to the spray nozzle can preferably be adjusted or controlled also, so that precisely predetermined amounts of coating material can be applied to a specific surface and thus also so that the thickness of the protective layer can be predetermined.

By adjusting the temperature of the coating material automatically to a desired nominal value, it is possible effectively to control the flow properties or viscosity of the coating material, to control its spray or application behavior, and ultimately to control certain properties of the protective layer. The process according to the invention is especially safe for the environment when the coating material is water-based and the water evaporates during the curing process.

According to another especially preferred embodiment of the process, it is provided that the coating material emerging from the spray nozzle or applicator nozzle is subjected to spray jet monitoring, in which the emerging coating material is introduced into the path of a beam of light, so that the interruption of the beam can be detected by an optical sensor and analyzed by a control unit. Before the protective layer itself is actually produced on the surface, the spray jet emerging from the spray nozzle and/or the strand or strip of material emerging from the applicator nozzle is analyzed to determine whether, for example, the width of the spray cone or of the strand or strip of material, which expands with increasing distance from the discharge opening of the applicator nozzle, has the desired form. If spray jet monitoring shows that the spray pattern is not optimal, a parameter such as the temperature of the coating material or the pressure of the coating material in a feed line to the spray nozzle or to the applicator nozzle can be varied, or the nozzle can be

cleaned until the desired spray pattern is obtained. Through these measures, it can be guaranteed that a uniform protective layer of sufficient thickness will be produced.

The process is especially advantageous when the coating material is sprayed on first and the strand or strip of material is then applied to the edges of the sprayed-on areas of coating material. In this way, it is possible with a single robot arm to spray a large area and then to produce a sharp edge contour by guiding the applicator nozzle along the edges. To produce a large coated area, it is advisable to use one or more spray nozzles to spray on several swathes of coating material essentially parallel to each other. According to an elaboration, it is provided that the spray nozzle and the applicator nozzle are moved by a robot arm along pre-programmable paths relative to the surface to be coated.

The previously described advantages of the process according to the invention are achieved in like manner by means of a device according to the invention, so that, to avoid repetition, reference is made herewith to the above description of the advantages of the process according to the invention.

The device according to the invention is advantageously elaborated in that the spray nozzle and the applicator nozzle are attached to a common frame so that they can be moved by means of a robot arm relative to the surface to be protected. A further elaboration provides that several applicator nozzles and spray nozzles are attached next to each other on the frame in such a way that they can be mounted at various distances from each other.

To arrive at different sets of flow conditions, especially to set different pressures, it is provided in accordance with an elaboration of the process

according to the invention that the spray nozzle and the applicator nozzle are fed independently of each other with coating material through two separate coating material lines. It can be advisable, for example, to use a much higher pressure for the spray nozzle than for the applicator nozzle, from which a continuous strand of material emerges. To set the desired pressure, an automatic pressure controller is provided in each of the coating material lines, by means of which the pressure of the coating material in the coating material lines can be adjusted to the desired value.

An optical system for monitoring the spray jet is preferably realized by a light source for producing a beam of light, by an optical sensor for detecting incident light and for generating an electrical signal as a function of the intensity of the incident light, and by a control unit connected to the optical sensor for evaluating the optical signals generated by the sensor, so that the coating material streams discharged by the applicator nozzle and the spray nozzle can be monitored. The material properties of the coating material can be influenced favorably by a heating device for tempering the material.

These and other features, objects and advantages of the invention will become more readily apparent to those of ordinary skill in the art upon review of the following detailed description, taken in conjunction with the accompanying drawings.

Brief Description of the Drawings

[The device and the process according to the invention are explained below on the basis of an exemplary embodiment. The single figure, in the form of] The Figure is a schematic diagram[, shows] of a device [or system] for the

production of a peel-off protective layer on the painted surfaces of motor vehicles or their bodies.

Detailed Description of the Invention

The exemplary embodiment of a device according to the invention comprises essentially two spray nozzles *2*, *4*; an applicator nozzle *6*; a system of supply lines, to be explained in greater detail below, for feeding coating material to the spray and applicator nozzles *2*, *4*, *6*; and a pump *8*, connected to a coating material source (not shown), for conveying the coating material.

The pump *8* is connected on the delivery side to a line *10*, to which a pressure transducer *12* for detecting the pressure of the coating material in the line *10* is connected. The line *10* divides in the flow direction of the coating material into two branches, in each of which a filter *18* and a valve are installed, so that the coating material, depending on the positions of the valves, is conveyed either through the filter *18* in branch *16* or through the filter *18* in branch *14*. In the line *20*, following after the branch lines *14*, *16*, there is another pressure transducer *22*. A conclusion concerning the state of the filters *18* can be drawn from the difference between the pressure value detected by transducer *22* and that detected by transducer *12*. Line *20* contains a flexible, possibly heatable, hose *24*.

Within a control panel *26*, located further along the course of the line *20*, there is a volume flow rate measuring cell *28*. The signals generated by the volume flow rate measuring cell *28* are transmitted over a signal line (shown in broken [line] lines) to a central switch box *30* in the panel *26*. The switch box *30* is connected by several lines *32*, also shown schematically in broken [line]

lines, to a control unit *34*, which is equipped with a display field and several buttons and switches for entering commands and which is possibly connected to the central control unit of a production plant.

At a T-distributor *36*, the line *20* divides into two separate coating material lines *38, 40*. An automatic membrane pressure controller *42, 44* and a pressure transducer *46, 48* are installed in each of these two coating material lines *38, 40*, so that it is possible to adjust the pressure in the further course of the coating material lines *38, 40* to different values and to measure those pressures. The automatic pressure controllers *42, 44* and pressure transducers *46, 48* are connected to the switch box *30* by signal lines, also shown in broken [line] lines. The coating material line *40* [leads] is connected by [way of] a flexible and thermally insulated hose *50* to the applicator nozzle *6*. The coating material line *38* [leads] is connected by [way of] a hose *52* to the two spray nozzles *2*, *4*, which can be supplied with coating material either simultaneously or, if desired, separately, via an appropriate set of connections.

An individually actuatable pneumatic applicator valve (not shown) is assigned to each of the spray nozzles *2*, *4* and to the applicator nozzle *6*, the valve needles of which can be moved by pistons, which can be moved pneumatically back and forth by compressed air relative to their valve seats to block or release the feed of coating material to the discharge openings. The applicator valves can be driven via compressed air lines [*52*] *54* containing electromagnetically actuated solenoid valves, which are themselves driven from the switch box *30* via the lines *32* with the control unit *34*. The solenoid valves are connected to a compressed air source *53*.

The spray nozzles *2*, *4*, and the applicator nozzle *6* are attached to a

common frame *56*. They can be mounted on the frame *56* at various distances away from each other. For this purpose, the spray and applicator nozzles *2*, *4*, *6* can be slid along a rail and locked in place there by clamping screws. The frame *56* is attached in turn to a robot arm (not shown) which moves along programmable routes, so that the spray nozzles *2*, *4* and the applicator nozzle *6* can be shifted along predetermined paths relative to a surface to be coated, which, in this exemplary embodiment, is a motor vehicle. In a manner not illustrated here, additional spray nozzles and applicator nozzles can also be attached to the frame *56*, if called for by a specific application.

Two schematically illustrated spray jet monitoring devices *58* are used to analyze the spray jets emerging from the spray guns *2*, *4* and the strand or strip of material emerging from the applicator nozzle *6*. By means of the previously described robot arm, the spray nozzles *2*, *4* and the applicator nozzle *6* can thus be moved up to the spray jet monitoring devices *58* so that analysis is possible. Each spray jet monitoring device *58* has a light source, preferably a laser, which produces a beam of light, and an optical sensor a certain distance away from the light source to detect the incident light and to generate an electrical signal as a function of the intensity of this incident light. The spray pattern obtained in an individual case can, for example, be analyzed with respect to a desired, predetermined width a certain distance away from the discharge opening of the associated spray nozzle *2*, *4*, or applicator nozzle *6*. It is also possible to study the degree of uniformity of the spray pattern. The electrical signals generated by the one or more optical sensors, which signals are a measure of the intensity of the incident light, are transmitted to an electrical or electronic control unit for evaluation of the signals and processed

there to obtain information concerning the spray pattern in question.

A compressed air-operated air motor *60* drives a rotating brush *62*, by means of which the discharge openings of the spray nozzles *2*, *4* and of the applicator nozzle *6* can be cleaned, the robot arm being used to bring the nozzles up to the brush *62*. The air motor *60* can be driven via a signal line *64*.

The operation of the device and the process according to the invention are described below.

The liquid coating material, which can be an aqueous dispersion or the like, is conveyed by means of the pump *8* through the line *10*. It flows through one of the filters *18* in the line *20* and through the volume flow rate measuring cell *28*. In a preferred exemplary embodiment, coating material is conveyed first through the coating material line *38* and the hose *52* to the spray nozzles *2*, *4* under a pressure of up to approximately 30 bars. The material is applied by the spray nozzles *2*, *4* as a flat coating to a vehicle body, in that the spray nozzles *2*, *4* are moved together with the frame *56* by a robot arm along a predetermined path, so that a uniformly applied coating of the material is sprayed onto the surface. For example, the spray nozzles *2*, *4* can be moved back and forth along essentially straight paths.

After completion of the spray process, the applicator valves of the spray [valves] <u>nozzles</u> *2*, *4* are closed. The applicator [valve] <u>nozzle</u> *6* is brought to the edge area of the previously applied spray coating, and the applicator valve of the applicator nozzle *6* is opened, so that the coating material is applied to the surface through the coating material line *40,* the hose *50,* and the applicator nozzle *6* in the form of an essentially continuous strand or strip of material emerging as a jet from the applicator nozzle *6*. The applicator nozzle *6* is

guided along the edge area of the sprayed-on area of coating material so that a completely closed protective layer is formed, which consists of the sprayed-on coating material and the coating material applied subsequently in the form of a continuous strand or strip of material. Because of the ability of the coating material to flow before it cures, the coating material sprayed on by the spray nozzles *2, 4* and the coating material applied by the applicator nozzle *6* coalesce with each other to form a single protective layer. This then cures completely. It can be peeled off by hand from the surface at a later time.

The protective layer which has been sprayed on and applied by the applicator nozzle *6* has a thickness such that, in the cured state, it forms a completely closed protective layer, which can be peeled off. The coating material strand or strip emerging from the applicator nozzle *6* can, for example, be produced by a slit nozzle; other types of nozzles could also be used. According to a variant of the process, coating material emerges from the applicator nozzle as a flat strip of material, which expands with increasing distance from the applicator nozzle.

The pressure in the coating material lines *38,* [*14*] *40* can be adjusted by means of the automatic pressure controllers *42, 44*. The same is true for the temperature of the coating material, which can be set or brought to a desired nominal value by means of a tempering device (not shown).

Before the protective layer itself is actually produced, the spray pattern of the spray nozzles *2*, *4* and of the applicator nozzle *6* can be studied by means of the spray jet monitoring devices *58*, as previously described.

While the present invention has been illustrated by a description of various preferred embodiments and while these embodiments has been

described in some detail, it is not the intention of the Applicants to restrict or in any way limit the scope of the appended claims to such detail. Additional advantages and modifications will readily appear to those skilled in the art. The various features of the invention may be used alone or in numerous combinations depending on the needs and preferences of the user. This has been a description of the present invention, along with the preferred methods of practicing the present invention as currently known. However, the invention itself should only be defined by the appended claims, wherein what is claimed is:

[List of Reference Numbers

2	spray nozzles
4	spray nozzles
6	applicator nozzle
8	pump
10	line
12	pressure transducer
14	branch line
16	branch line
18	filter
20	line
22	pressure transducer
24	hose
26	panel
28	volume flow rate measuring cell
30	switch box
32	lines
34	control unit
36	T-distributor
38	coating material lines
40	coating material lines
42	automatic membrane pressure controller
44	automatic membrane pressure controller
46	pressure transducer

48	pressure transducer
50	hose
52	hose
53	compressed air source
54	compressed air lines
56	frame
58	spray jet monitoring device
60	air motor
62	brush
64	signal line]

SUBSTITUTE SPECIFICATION

PROCESS AND DEVICE FOR PRODUCING A PEEL-OFF PROTECTIVE LAYER FOR SURFACES, ESPECIALLY THE PAINTED SURFACES OF MOTOR VEHICLE BODIES

Field of the Invention

The present invention pertains to a process and a device for producing a peel-off protective layer for surfaces, especially the painted surfaces of motor vehicle bodies, in which a curable liquid coating material is sprayed from a spray nozzle onto the surface to be protected and forms there a two-dimensional protective layer when cured.

Peel-off protective layers are placed on the painted surfaces of motor vehicles to protect them from environmental influences such as dirt and intense sunlight, especially during transport from the motor vehicle manufacturer and until the time of delivery to the customer. The protective layer is produced at the manufacturer's plant by the application of a liquid to the painted surface of a motor vehicle, and then this liquid is cured or solidified. The liquid can be an aqueous dispersion from which the water evaporates during curing, so that a kind of peel-off film is formed on the surface. The film thus produced can then be peeled off by hand before the vehicle is delivered to the buyer.

A significant disadvantage of conventional processes is that, because the liquid coating material is sprayed on, it is impossible to obtain a sharp contour at the edges of the sprayed-on areas of coating material; instead, individual particles or droplets are formed in the edge areas, which are

separate and detached from the continuous protective layer ("overspray"). A protective layer in the form of individual particles does not offer sufficient protection to the paint after curing and also makes it almost impossible for the cured protective layer to be gripped by hand so that it can be peeled off. The individual particles, furthermore, must be removed manually or by some other labor-intensive means.

For these and other reasons, it would be desirable to provide a process and a device for producing a sharply contoured protective layer on a surface, such as the painted surfaces of motor vehicle bodies.

Brief Summary of the Invention

The invention is directed to a process in which coating material emerges essentially as a continuous strand or strip of material from an applicator nozzle and is applied to the surface to be coated at the edges of the areas which have been sprayed with the coating material.

The invention is further directed to a device having at least one applicator nozzle for the application of coating material as an essentially continuous strand or strip of material to the surface to be coated.

The process according to the invention and the device according to the invention make it possible to produce a protective layer for surfaces having sharply defined lateral edges and thus a defined size. Because a continuous or nearly continuous strand or strip of material is applied to the edge areas of the sprayed-on coating material, a clean, sharply contoured edge is formed, without the occurrence of individual particles or droplets (overspray), which then cure on the surface. The sharply contoured, overspray-free edge can, after it has

cured, be gripped easily by hand and lifted, and the protective layer thus produced can then be easily peeled off. According to the invention, a relatively large area is coated by spraying on the coating material, whereas, during or after the spraying step, an applicator nozzle which produces an essentially continuous strand or strip of material is used to produce a sharp-edged, overspray-free coating in the area of the outer edges of the sprayed-on coating, where individual sprayed-on liquid particles can be scattered.

According to an especially preferred embodiment of the process according to the invention, it is provided that the protective layer sprayed on by the spray nozzle and the protective layer applied by the applicator nozzle consist of the same coating material and coalesce to form a single protective layer on the surface before they have cured. The viscosity of the coating material, which is essentially a function of temperature, is selected so that the coating material sprayed on by the spray nozzle and the coating material applied by the applicator nozzle flow into each other and form a single layer. The sprayed-on particles in the edge area coalesce completely with the coating material which has been applied as an essentially continuous strand or strip of material.

According to an elaboration of the process according to the invention, it is proposed that the protective layer sprayed on by the spray nozzle and the protective layer applied by the applicator nozzle have a thickness such that a protective layer is formed which, in the completely cured state, forms a completely closed protective layer which is essentially impermeable to water, gas, and dust and which can be peeled off by hand. A protective layer of this type is liquid-repellent, but does not usually dissolve upon contact with water

and provides reliable protection during transport.

An especially preferred alternative embodiment of the process according to the invention is characterized in that the coating material emerges from the applicator nozzle as a flat strip of material which expands as its distance from the applicator nozzle increases. A flat strip of material of this type can be laid onto the surface in a defined manner at the edges of the previously or simultaneously sprayed-on coating. In the cured state, the protective layer can then be gripped by hand at this edge and peeled off without causing the protective layer to tear. For example, a slit nozzle or a specially designed nozzle with an essentially rectangular discharge opening could be used.

According to an alternative embodiment, it is provided that several strands or strips of material are applied from several applicator nozzles to the edge areas of the coating material sprayed onto the surface. In this way, a relatively wide overspray area can be covered with coating material.

To obtain a protective layer with a large surface area, it is provided that the coating material is sprayed on in an overlapping manner by means of several adjacent spray nozzles. The degree of overlap can be varied; it depends on the pressure of the coating material in the feed line and on the distance between the individual spray nozzles.

Another elaboration of the invention is characterized in that the spray nozzle and the applicator nozzle are fed from a common coating material source but by two coating material streams which are at least partially separate from each other. Because of the use of two separate coating material streams, it is possible for the pressure in one of the feed lines to be different from that in the other. The pressure of the coating material in the feed line to the spray

nozzle will usually be much higher than the pressure in the coating material feed line to the applicator nozzle. In addition, the coating material can be supplied to the spray nozzle and to the applicator nozzle in alternation; in most cases, according to a preferred embodiment described in greater detail further below, the material will first be sprayed on over a wide area, and then a sharply contoured edge will be produced at the edge areas by means of the applicator nozzle.

According to a further elaboration of the process, it is provided that the pressures in the separate coating material streams leading to the applicator nozzle and to the spray nozzle are adjustable or controllable. The flow rates, measured either by weight or volume, of the separate coating material streams being supplied to the applicator nozzle and to the spray nozzle can preferably be adjusted or controlled also, so that precisely predetermined amounts of coating material can be applied to a specific surface and thus also so that the thickness of the protective layer can be predetermined.

By adjusting the temperature of the coating material automatically to a desired nominal value, it is possible effectively to control the flow properties or viscosity of the coating material, to control its spray or application behavior, and ultimately to control certain properties of the protective layer. The process according to the invention is especially safe for the environment when the coating material is water-based and the water evaporates during the curing process.

According to another especially preferred embodiment of the process, it is provided that the coating material emerging from the spray nozzle or applicator nozzle is subjected to spray jet monitoring, in which the emerging

coating material is introduced into the path of a beam of light, so that the interruption of the beam can be detected by an optical sensor and analyzed by a control unit. Before the protective layer itself is actually produced on the surface, the spray jet emerging from the spray nozzle and/or the strand or strip of material emerging from the applicator nozzle is analyzed to determine whether, for example, the width of the spray cone or of the strand or strip of material, which expands with increasing distance from the discharge opening of the applicator nozzle, has the desired form. If spray jet monitoring shows that the spray pattern is not optimal, a parameter such as the temperature of the coating material or the pressure of the coating material in a feed line to the spray nozzle or to the applicator nozzle can be varied, or the nozzle can be cleaned until the desired spray pattern is obtained. Through these measures, it can be guaranteed that a uniform protective layer of sufficient thickness will be produced.

The process is especially advantageous when the coating material is sprayed on first and the strand or strip of material is then applied to the edges of the sprayed-on areas of coating material. In this way, it is possible with a single robot arm to spray a large area and then to produce a sharp edge contour by guiding the applicator nozzle along the edges. To produce a large coated area, it is advisable to use one or more spray nozzles to spray on several swathes of coating material essentially parallel to each other. According to an elaboration, it is provided that the spray nozzle and the applicator nozzle are moved by a robot arm along pre-programmable paths relative to the surface to be coated.

The previously described advantages of the process according to the

invention are achieved in like manner by means of a device according to the invention, so that, to avoid repetition, reference is made herewith to the above description of the advantages of the process according to the invention.

The device according to the invention is advantageously elaborated in that the spray nozzle and the applicator nozzle are attached to a common frame so that they can be moved by means of a robot arm relative to the surface to be protected. A further elaboration provides that several applicator nozzles and spray nozzles are attached next to each other on the frame in such a way that they can be mounted at various distances from each other.

To arrive at different sets of flow conditions, especially to set different pressures, it is provided in accordance with an elaboration of the process according to the invention that the spray nozzle and the applicator nozzle are fed independently of each other with coating material through two separate coating material lines. It can be advisable, for example, to use a much higher pressure for the spray nozzle than for the applicator nozzle, from which a continuous strand of material emerges. To set the desired pressure, an automatic pressure controller is provided in each of the coating material lines, by means of which the pressure of the coating material in the coating material lines can be adjusted to the desired value.

An optical system for monitoring the spray jet is preferably realized by a light source for producing a beam of light, by an optical sensor for detecting incident light and for generating an electrical signal as a function of the intensity of the incident light, and by a control unit connected to the optical sensor for evaluating the optical signals generated by the sensor, so that the coating material streams discharged by the applicator nozzle and the spray nozzle can

be monitored. The material properties of the coating material can be influenced favorably by a heating device for tempering the material.

These and other features, objects and advantages of the invention will become more readily apparent to those of ordinary skill in the art upon review of the following detailed description, taken in conjunction with the accompanying drawings.

Brief Description of the Drawings

The Figure is a schematic diagram of a device for the production of a peel-off protective layer on the painted surfaces of motor vehicles or their bodies.

Detailed Description of the Invention

The exemplary embodiment of a device according to the invention comprises essentially two spray nozzles *2*, *4*; an applicator nozzle *6*; a system of supply lines, to be explained in greater detail below, for feeding coating material to the spray and applicator nozzles *2*, *4*, *6*; and a pump *8*, connected to a coating material source (not shown), for conveying the coating material.

The pump *8* is connected on the delivery side to a line *10*, to which a pressure transducer *12* for detecting the pressure of the coating material in the line *10* is connected. The line *10* divides in the flow direction of the coating material into two branches, in each of which a filter *18* and a valve are installed, so that the coating material, depending on the positions of the valves, is conveyed either through the filter *18* in branch *16* or through the filter *18* in branch *14*. In the line *20*, following after the branch lines *14*, *16*, there is

another pressure transducer *22*. A conclusion concerning the state of the filters *18* can be drawn from the difference between the pressure value detected by transducer *22* and that detected by transducer *12*. Line *20* contains a flexible, possibly heatable, hose *24*.

Within a control panel *26*, located further along the course of the line *20*, there is a volume flow rate measuring cell *28*. The signals generated by the volume flow rate measuring cell *28* are transmitted over a signal line (shown in broken lines) to a central switch box *30* in the panel *26*. The switch box *30* is connected by several lines *32*, also shown schematically in broken lines, to a control unit *34*, which is equipped with a display field and several buttons and switches for entering commands and which is possibly connected to the central control unit of a production plant.

At a T-distributor *36*, the line *20* divides into two separate coating material lines *38, 40*. An automatic membrane pressure controller *42, 44* and a pressure transducer *46, 48* are installed in each of these two coating material lines *38, 40*, so that it is possible to adjust the pressure in the further course of the coating material lines *38, 40* to different values and to measure those pressures. The automatic pressure controllers *42, 44* and pressure transducers *46, 48* are connected to the switch box *30* by signal lines, also shown in broken lines. The coating material line *40* is connected by a flexible and thermally insulated hose *50* to the applicator nozzle *6*. The coating material line *38* is connected by a hose *52* to the two spray nozzles *2, 4*, which can be supplied with coating material either simultaneously or, if desired, separately, via an appropriate set of connections.

An individually actuatable pneumatic applicator valve (not shown) is

assigned to each of the spray nozzles *2*, *4* and to the applicator nozzle *6*, the valve needles of which can be moved by pistons, which can be moved pneumatically back and forth by compressed air relative to their valve seats to block or release the feed of coating material to the discharge openings. The applicator valves can be driven via compressed air lines *54* containing electromagnetically actuated solenoid valves, which are themselves driven from the switch box *30* via the lines *32* with the control unit *34*. The solenoid valves are connected to a compressed air source *53*.

The spray nozzles *2*, *4*, and the applicator nozzle *6* are attached to a common frame *56*. They can be mounted on the frame *56* at various distances away from each other. For this purpose, the spray and applicator nozzles *2*, *4*, *6* can be slid along a rail and locked in place there by clamping screws. The frame *56* is attached in turn to a robot arm (not shown) which moves along programmable routes, so that the spray nozzles *2*, *4* and the applicator nozzle *6* can be shifted along predetermined paths relative to a surface to be coated, which, in this exemplary embodiment, is a motor vehicle. In a manner not illustrated here, additional spray nozzles and applicator nozzles can also be attached to the frame *56*, if called for by a specific application.

Two schematically illustrated spray jet monitoring devices *58* are used to analyze the spray jets emerging from the spray guns *2*, *4* and the strand or strip of material emerging from the applicator nozzle *6*. By means of the previously described robot arm, the spray nozzles *2*, *4* and the applicator nozzle *6* can thus be moved up to the spray jet monitoring devices *58* so that analysis is possible. Each spray jet monitoring device *58* has a light source, preferably a laser, which produces a beam of light, and an optical sensor a certain distance

away from the light source to detect the incident light and to generate an electrical signal as a function of the intensity of this incident light. The spray pattern obtained in an individual case can, for example, be analyzed with respect to a desired, predetermined width a certain distance away from the discharge opening of the associated spray nozzle *2*, *4*, or applicator nozzle *6*. It is also possible to study the degree of uniformity of the spray pattern. The electrical signals generated by the one or more optical sensors, which signals are a measure of the intensity of the incident light, are transmitted to an electrical or electronic control unit for evaluation of the signals and processed there to obtain information concerning the spray pattern in question.

A compressed air-operated air motor *60* drives a rotating brush *62*, by means of which the discharge openings of the spray nozzles *2*, *4* and of the applicator nozzle *6* can be cleaned, the robot arm being used to bring the nozzles up to the brush *62*. The air motor *60* can be driven via a signal line *64*.

The operation of the device and the process according to the invention are described below.

The liquid coating material, which can be an aqueous dispersion or the like, is conveyed by means of the pump *8* through the line *10*. It flows through one of the filters *18* in the line *20* and through the volume flow rate measuring cell *28*. In a preferred exemplary embodiment, coating material is conveyed first through the coating material line *38* and the hose *52* to the spray nozzles *2*, *4* under a pressure of up to approximately 30 bars. The material is applied by the spray nozzles *2*, *4* as a flat coating to a vehicle body, in that the spray nozzles *2*, *4* are moved together with the frame *56* by a robot arm along a predetermined path, so that a uniformly applied coating of the material is

sprayed onto the surface. For example, the spray nozzles *2*, *4* can be moved back and forth along essentially straight paths.

After completion of the spray process, the applicator valves of the spray nozzles *2*, *4* are closed. The applicator nozzle *6* is brought to the edge area of the previously applied spray coating, and the applicator valve of the applicator nozzle *6* is opened, so that the coating material is applied to the surface through the coating material line *40,* the hose *50,* and the applicator nozzle *6* in the form of an essentially continuous strand or strip of material emerging as a jet from the applicator nozzle *6*. The applicator nozzle *6* is guided along the edge area of the sprayed-on area of coating material so that a completely closed protective layer is formed, which consists of the sprayed-on coating material and the coating material applied subsequently in the form of a continuous strand or strip of material. Because of the ability of the coating material to flow before it cures, the coating material sprayed on by the spray nozzles *2, 4* and the coating material applied by the applicator nozzle *6* coalesce with each other to form a single protective layer. This then cures completely. It can be peeled off by hand from the surface at a later time.

The protective layer which has been sprayed on and applied by the applicator nozzle *6* has a thickness such that, in the cured state, it forms a completely closed protective layer, which can be peeled off. The coating material strand or strip emerging from the applicator nozzle *6* can, for example, be produced by a slit nozzle; other types of nozzles could also be used. According to a variant of the process, coating material emerges from the applicator nozzle as a flat strip of material, which expands with increasing distance from the applicator nozzle.

The pressure in the coating material lines *38, 40* can be adjusted by means of the automatic pressure controllers *42, 44*. The same is true for the temperature of the coating material, which can be set or brought to a desired nominal value by means of a tempering device (not shown).

Before the protective layer itself is actually produced, the spray pattern of the spray nozzles *2*, *4* and of the applicator nozzle *6* can be studied by means of the spray jet monitoring devices *58*, as previously described.

While the present invention has been illustrated by a description of various preferred embodiments and while these embodiments has been described in some detail, it is not the intention of the Applicants to restrict or in any way limit the scope of the appended claims to such detail. Additional advantages and modifications will readily appear to those skilled in the art. The various features of the invention may be used alone or in numerous combinations depending on the needs and preferences of the user. This has been a description of the present invention, along with the preferred methods of practicing the present invention as currently known. However, the invention itself should only be defined by the appended claims, wherein what is claimed is:

PROCESS AND DEVICE FOR PRODUCING A PEEL-OFF PROTECTIVE LAYER FOR SURFACES, ESPECIALLY THE PAINTED SURFACES OF MOTOR VEHICLE BODIES

The present invention pertains to a process for producing a peel-off protective layer for surfaces, especially the painted surfaces of motor vehicle bodies, in which a curable liquid coating material is sprayed from a spray nozzle onto the surface to be protected and forms there a two-dimensional protective layer, which then cures.

The invention also pertains to a device for producing a peel-off protective layer for surfaces, especially the painted surfaces of motor vehicle bodies, with a spray nozzle, which can be supplied with liquid coating material from a coating material source, so that a curable liquid coating material can be sprayed onto the surface to be protected, where the spray nozzle and the surface can be moved relative to each other.

A process and a device of this type known from DE 196-52,728 A1 are used primarily to produce peel-off protective layers on the painted surfaces of motor vehicles to protect them from environmental influences such as dirt and intense sunlight, especially during transport from the motor vehicle manufacturer and until the time of delivery to the customer. The protective layer is thus produced at the manufacturer's plant by the application of a liquid to the painted surface of a motor vehicle, and then this liquid is cured or solidified. The liquid can be an aqueous dispersion from which the water evaporates during curing, so that a kind of peel-off film is formed on the surface. The film thus produced can then be peeled off by hand before the vehicle is delivered to the buyer.

A significant disadvantage of the know process is that, because the liquid coating material is sprayed on, it is impossible to obtain a sharp contour at the edges of the sprayed-on areas of coating material; instead, individual particles or droplets are formed in the edge areas, which are separate and de-

tached from the continuous protective layer ("overspray"). A protective layer in the form of individual particles does not offer sufficient protection to the paint after curing and also makes it almost impossible for the cured protective layer to be gripped by hand so that it can be peeled off. The individual particles, furthermore, must be removed manually or by some other labor-intensive means.

The task of the present invention is to provide a process and a device of the general type indicated above by means of which a sharply contoured protective layer can be easily produced, especially for motor vehicle bodies.

The invention accomplishes this task in a process of the general type indicated above in that coating material which emerges essentially as a continuous strand or strip of material from an applicator nozzle is applied to the surface to be coated at the edges of the areas which have been sprayed with the coating material.

The invention also accomplishes its task with a device of the general type indicated above by means of at least one applicator nozzle for the application of coating material as an essentially continuous strand or strip of material to the surface to be coated.

The process according to the invention and the device according to the invention make it possible to produce a protective layer for surfaces which has a sharply defined lateral edge and thus a defined size. Because a continuous or nearly continuous strand or strip of material is applied to the edge areas of the sprayed-on coating material, a clean, sharply contoured edge is formed, without the occurrence of individual particles or droplets (overspray), which then cure on the surface. The sharply contoured, overspray-free edge can, after it has cured, be gripped easily by hand and lifted, and the protective layer thus produced can then be easily peeled off. According to the invention, a relatively large area is coated by spraying on the coating material,

whereas, during or after the spraying step, an applicator nozzle which produces an essentially continuous strand or strip of material is used to produce a sharp-edged, overspray-free coating in the area of the outer edges of the sprayed-on coating, where individual sprayed-on liquid particles can be scattered.

According to an especially preferred embodiment of the process according to the invention, it is provided that the protective layer sprayed on by means of the spray nozzle and the protective layer applied by means of the applicator nozzle consist of the same coating material and coalesce to form a single protective layer on the surface before they have cured. The viscosity of the coating material, which is essentially a function of temperature, is selected so that the coating material sprayed on by the spray nozzle and the coating material applied by the applicator nozzle flow into each other and form a single layer. The sprayed-on particles in the edge area coalesce completely with the coating material which has been applied as an essentially continuous strand or strip of material.

According to an elaboration of the process according to the invention, it is proposed that the protective layer sprayed on by the spray nozzle and the protective layer applied by the applicator nozzle have a thickness such that a protective layer is formed which, in the completely cured state, forms a completely closed protective layer which is essentially impermeable to water, gas, and dust and which can be peeled off by hand. A protective layer of this type is liquid-repellent, but does not usually dissolve upon contact with water and provides reliable protection during transport.

An especially preferred alternative embodiment of the process according to the invention is characterized in that the coating material emerges from the applicator nozzle as a flat strip of material which expands as its distance from the applicator nozzle increases. A flat strip of material of this type

can be laid onto the surface in a defined manner at the edges of the previously or simultaneously sprayed-on coating. In the cured state, the protective layer can then be gripped by hand at this edge and peeled off without causing the protective layer to tear. For example, a slit nozzle or a specially designed nozzle with an essentially rectangular discharge opening could be used.

According to an alternative embodiment, it is provided that several strands or strips of material are applied from several applicator nozzles to the edge areas of the coating material sprayed onto the surface. In this way, a relatively wide overspray area can be covered with coating material.

To obtain a protective layer with a large surface area, it is provided that the coating material is sprayed on in an overlapping manner by means of several adjacent spray nozzles. The degree of overlap can be varied; it depends on the pressure of the coating material in the feed line and on the distance between the individual spray nozzles.

Another elaboration of the invention is characterized in that the spray nozzle and the applicator nozzle are fed from a common coating material source but by two coating material streams which are at least partially separate from each other. Because of the use of two separate coating material streams, it is possible for the pressure in one of the feed lines to be different from that in the other. The pressure of the coating material in the feed line to the spray nozzle will usually be much higher than the pressure in the coating material feed line to the applicator nozzle. In addition, the coating material can be supplied to the spray nozzle and to the applicator nozzle in alternation; in most cases, according to a preferred embodiment described in greater detail further below, the material will first be sprayed on over a wide area, and then a sharply contoured edge will be produced at the edge areas by means of the applicator nozzle.

According to a further elaboration of the process, it is provided that the pressures in the separate coating material streams leading to the applicator nozzle and to the spray nozzle are adjustable or controllable. The flow rates, measured either by weight or volume, of the separate coating material streams being supplied to the applicator nozzle and to the spray nozzle can preferably be adjusted or controlled also, so that precisely predetermined amounts of coating material can be applied to a specific surface and thus also so that the thickness of the protective layer can be predetermined.

By adjusting the temperature of the coating material automatically to a desired nominal value, it is possible effectively to control the flow properties or viscosity of the coating material, to control its spray or application behavior, and ultimately to control certain properties of the protective layer. The process according to the invention is especially safe for the environment when the coating material is water-based and the water evaporates during the curing process.

According to another especially preferred embodiment of the process, it is provided that the coating material emerging from the spray nozzle or applicator nozzle is subjected to spray jet monitoring, in which the emerging coating material is introduced into the path of a beam of light, so that the interruption of the beam can be detected by an optical sensor and analyzed by a control unit. Before the protective layer itself is actually produced on the surface, the spray jet emerging from the spray nozzle and/or the strand or strip of material emerging from the applicator nozzle is analyzed to determine whether, for example, the width of the spray cone or of the strand or strip of material, which expands with increasing distance from the discharge opening of the applicator nozzle, has the desired form. If spray jet monitoring shows that the spray pattern is not optimal, a parameter such as the temperature of the coating material or the pressure of the coating material in a feed line to

the spray nozzle or to the applicator nozzle can be varied, or the nozzle can be cleaned until the desired spray pattern is obtained. Through these measures, it can be guaranteed that a uniform protective layer of sufficient thickness will be produced.

The process is especially advantageous when the coating material is sprayed on first and the strand or strip of material is then applied to the edges of the sprayed-on areas of coating material. In this way, it is possible with a single robot arm to spray a large area and then to produce a sharp edge contour by guiding the applicator nozzle along the edges. To produce a large coated area, it is advisable to use one or more spray nozzles to spray on several swathes of coating material essentially parallel to each other. According to an elaboration, it is provided that the spray nozzle and the applicator nozzle are moved by a robot arm along pre-programmable paths relative to the surface to be coated.

The previously described advantages of the process according to the invention are achieved in like manner by means of a device according to the invention, so that, to avoid repetition, reference is made herewith to the above description of the advantages of the process according to the invention.

The device according to the invention is advantageously elaborated in that the spray nozzle and the applicator nozzle are attached to a common frame so that they can be moved by means of a robot arm relative to the surface to be protected. A further elaboration provides that several applicator nozzles and spray nozzles are attached next to each other on the frame in such a way that they can be mounted at various distances from each other.

To arrive at different sets of flow conditions, especially to set different pressures, it is provided in accordance with an elaboration of the process according to the invention that the spray nozzle and the applicator nozzle are fed independently of each other with coating material through two separate

coating material lines. It can be advisable, for example, to use a much higher pressure for the spray nozzle than for the applicator nozzle, from which a continuous strand of material emerges. To set the desired pressure, an automatic pressure controller is provided in each of the coating material lines, by means of which the pressure of the coating material in the coating material lines can be adjusted to the desired value.

An optical system for monitoring the spray jet is preferably realized by a light source for producing a beam of light, by an optical sensor for detecting incident light and for generating an electrical signal as a function of the intensity of the incident light, and by a control unit connected to the optical sensor for evaluating the optical signals generated by the sensor, so that the coating material streams discharged by the applicator nozzle and the spray nozzle can be monitored. The material properties of the coating material can be influenced favorably by a heating device for tempering the material.

The device and the process according to the invention are explained below on the basis of an exemplary embodiment. The single figure, in the form of a schematic diagram, shows a device or system for the production of a peel-off protective layer on the painted surfaces of motor vehicles or their bodies.

The exemplary embodiment of a device according to the invention comprises essentially two spray nozzles *2*, *4*; an applicator nozzle *6*; a system of supply lines, to be explained in greater detail below, for feeding coating material to the spray and applicator nozzles *2*, *4*, *6*; and a pump *8*, connected to a coating material source (not shown), for conveying the coating material.

The pump *8* is connected on the delivery side to a line *10*, to which a pressure transducer *12* for detecting the pressure of the coating material in the line *10* is connected. The line *10* divides in the flow direction of the coating material into two branches, in each of which a filter *18* and a valve are installed, so that the coating material, depending on the positions of the

valves, is conveyed either through the filter *18* in branch *16* or through the filter *18* in branch *14*. In the line *20*, following after the branch lines *14*, *16*, there is another pressure transducer *22*. A conclusion concerning the state of the filters *18* can be drawn from the difference between the pressure value detected by transducer *22* and that detected by transducer *12*. Line *20* contains a flexible, possibly heatable, hose *24*.

Within a control panel *26*, located further along the course of the line *20*, there is a volume flow rate measuring cell *28*. The signals generated by the volume flow rate measuring cell *28* are transmitted over a signal line (shown in broken line) to a central switch box *30* in the panel *26*. The switch box *30* is connected by several lines *32*, also shown schematically in broken line, to a control unit *34*, which is equipped with a display field and several buttons and switches for entering commands and which is possibly connected to the central control unit of a production plant.

At a T-distributor *36*, the line *20* divides into two separate coating material lines *38*, *40*. An automatic membrane pressure controller *42*, *44* and a pressure transducer *46*, *48* are installed in each of these two coating material lines *38*, *40*, so that it is possible to adjust the pressure in the further course of the coating material lines *38*, *40* to different values and to measure those pressures. The automatic pressure controllers *42*, *44* and pressure transducers *46*, *48* are connected to the switch box *30* by signal lines, also shown in broken line. The coating material line *40* leads by way of a flexible and thermally insulated hose *50* to the applicator nozzle *6*. The coating material line *38* leads by way of a hose *52* to the two spray nozzles *2*, *4*, which can be supplied with coating material either simultaneously or, if desired, separately, via an appropriate set of connections.

An individually actuatable pneumatic applicator valve is assigned to each of the spray nozzles *2*, *4* and to the applicator nozzle *6*, the valve needles of

which can be moved by pistons, which can be moved pneumatically back and forth by compressed air relative to their valve seats to block or release the feed of coating material to the discharge openings. The applicator valves can be driven via compressed air lines *52* containing electromagnetically actuated solenoid valves, which are themselves driven from the switch box *30* via the lines *32* with the control unit *34*. The solenoid valves are connected to a compressed air source *53*.

The spray nozzles *2*, *4*, and the applicator nozzle *6* are attached to a common frame *56*. They can be mounted on the frame *56* at various distances away from each other. For this purpose, the spray and applicator nozzles *2*, *4*, *6* can be slid along a rail and locked in place there by clamping screws. The frame *56* is attached in turn to a robot arm (not shown) which moves along programmable routes, so that the spray nozzles *2*, *4* and the applicator nozzle *6* can be shifted along predetermined paths relative to a surface to be coated, which, in this exemplary embodiment, is a motor vehicle. In a manner not illustrated here, additional spray nozzles and applicator nozzles can also be attached to the frame *56*, if called for by a specific application.

Two schematically illustrated spray jet monitoring devices *58* are used to analyze the spray jets emerging from the spray guns *2*, *4* and the strand or strip of material emerging from the applicator nozzle *6*. By means of the previously described robot arm, the spray nozzles *2*, *4* and the applicator nozzle *6* can thus be moved up to the spray jet monitoring devices *58* so that analysis is possible. Each spray jet monitoring device *58* has a light source, preferably a laser, which produces a beam of light, and an optical sensor a certain distance away from the light source to detect the incident light and to generate an electrical signal as a function of the intensity of this incident light. The spray pattern obtained in an individual case can, for example, be analyzed with respect to a desired, predetermined width a certain distance

away from the discharge opening of the associated spray nozzle *2*, *4*, or applicator nozzle *6*. It is also possible to study the degree of uniformity of the spray pattern. The electrical signals generated by the one or more optical sensors, which signals are a measure of the intensity of the incident light, are transmitted to an electrical or electronic control unit for evaluation of the signals and processed there to obtain information concerning the spray pattern in question.

A compressed air-operated air motor *60* drives a rotating brush *62*, by means of which the discharge openings of the spray nozzles *2*, *4* and of the applicator nozzle *6* can be cleaned, the robot arm being used to bring the nozzles up to the brush *62*. The air motor *60* can be driven via a signal line *64*.

The operation of the device and the process according to the invention are described below.

The liquid coating material, which can be an aqueous dispersion or the like, is conveyed by means of the pump *8* through the line *10*. It flows through one of the filters *18* in the line *20* and through the volume flow rate measuring cell *28*. In a preferred exemplary embodiment, coating material is conveyed first through the coating material line *38* and the hose *52* to the spray nozzles *2*, *4* under a pressure of up to approximately 30 bars. The material is applied by the spray nozzles *2*, *4* as a flat coating to a vehicle body, in that the spray nozzles *2*, *4* are moved together with the frame *56* by a robot arm along a predetermined path, so that a uniformly applied coating of the material is sprayed onto the surface. For example, the spray nozzles *2*, *4* can be moved back and forth along essentially straight paths.

After completion of the spray process, the applicator valves of the spray valves [*sic; spray nozzles -- Tr. Ed.*] *2*, *4* are closed. The applicator valve [*sic; applicator nozzle -- Tr. Ed.*] *6* is brought to the edge area of the previously applied spray coating, and the applicator valve of the applicator noz-

zle *6* is opened, so that the coating material is applied to the surface through the coating material line *40*, the hose *50*, and the applicator nozzle *6* in the form of an essentially continuous strand or strip of material emerging as a jet from the applicator nozzle *6*. The applicator nozzle *6* is guided along the edge area of the sprayed-on area of coating material so that a completely closed protective layer is formed, which consists of the sprayed-on coating material and the coating material applied subsequently in the form of a continuous strand or strip of material. Because of the ability of the coating material to flow before it cures, the coating material sprayed on by the spray nozzles *2*, *4* and the coating material applied by the applicator nozzle *6* coalesce with each other to form a single protective layer. This then cures completely. It can be peeled off by hand from the surface at a later time.

The protective layer which has been sprayed on and applied by the applicator nozzle *6* has a thickness such that, in the cured state, it forms a completely closed protective layer, which can be peeled off. The coating material strand or strip emerging from the applicator nozzle *6* can, for example, be produced by a slit nozzle; other types of nozzles could also be used. According to a variant of the process, coating material emerges from the applicator nozzle as a flat strip of material, which expands with increasing distance from the applicator nozzle.

The pressure in the coating material lines *38*, *14* [*sic? "38 and 40?" -- Tr. Ed.*] can be adjusted by means of the automatic pressure controllers *42*, *44*. The same is true for the temperature of the coating material, which can be set or brought to a desired nominal value by means of a tempering device (not shown).

Before the protective layer itself is actually produced, the spray pattern of the spray nozzles *2*, *4* and of the applicator nozzle *6* can be studied by means of the spray jet monitoring devices *58*, as previously described.

List of Reference Numbers

2	spray nozzles
4	spray nozzles
6	applicator nozzle
8	pump
10	line
12	pressure transducer
14	branch line
16	branch line
18	filter
20	line
22	pressure transducer
24	hose
26	panel
28	volume flow rate measuring cell
30	switch box
32	lines
34	control unit
36	T-distributor
38	coating material lines
40	coating material lines
42	automatic membrane pressure controller
44	automatic membrane pressure controller
46	pressure transducer
48	pressure transducer
50	hose
52	hose
53	compressed air source
54	compressed air lines
56	frame
58	spray jet monitoring device
60	air motor
62	brush
64	signal line

CLAIM(S)

1. Process for producing a peel-off protective layer for surfaces, especially for painted surfaces of motor vehicle bodies, in which a curable liquid coating material is sprayed by a spray nozzle (*2*, *4*) onto the surface to be protected, where it forms a two-dimensional protective layer, which cures, characterized in that coating material emerging essentially as a continuous strand or strip of material from an applicator nozzle (*6*) is applied to the surface to be coated at the edges of the areas of the coating material which has been sprayed onto the surface.

2. Process according to Claim 1, characterized in that the protective layer sprayed on by the spray nozzle (*2*, *4*) and the protective layer applied by the applicator nozzle (*6*) consist of the same material, and in that they coalesce with each other on the surface to form a single protective layer before they cure.

3. Process according to Claim 2, characterized in that the protective layer sprayed on by the spray nozzle (*2*, *4*) and the protective layer applied by the applicator nozzle (*6*) have a thickness such that a protective layer is formed which, in the cured state, forms a completely closed protective layer which is essentially impermeable to water, gas, and dust and which can be peeled off by hand.

4. Process according to one of the preceding claims, characterized in that the coating material emerges from the applicator nozzle (*6*) as a flat strip of material which increases in width with increasing distance from the applicator nozzle.

5. Process according to one of the preceding claims, characterized in that several strands or strips are applied from several applicator nozzles (*6*) to the edges of the areas of the coating material which has been sprayed onto

the surface.

6. Process according to one of the preceding claims, characterized in that the coating material is sprayed on in overlapping fashion by means of several adjacent spray nozzles (2, 4).

7. Process according to one of the preceding claims, characterized in that the spray nozzle (2, 4) and the applicator nozzle (6) are fed from a common coating material source but by two coating material streams which are separate from each other.

8. Process according to Claim 7, characterized in that the pressures in the separate coating material streams leading to the applicator nozzle (6) and to the spray nozzle (2, 4) can be adjusted or automatically controlled.

9. Process according to Claim 7 or Claim 8, characterized in that the flow rates, measured either by weight or volume, of the separate coating material streams leading to the applicator nozzle (6) and to the spray nozzle (2, 4) can be adjusted or automatically controlled.

10. Process according to one of the preceding claims, characterized in that the temperature of the coating material can be automatically brought to a desired nominal value.

11. Process according to one of the preceding claims, characterized in that the coating material is water-based and in that the water evaporates during the curing process.

12. Process according to one of the preceding claims, characterized in that the coating material emerging from the spray nozzle (2, 4) or from the applicator nozzle (6) is subjected to a spray jet monitoring process, in which the emerging coating material is introduced into the path of a beam of light so that an optical sensor can detect the interruption of the light beam and a control unit (34) can analyze the resulting signals.

13. Process according to one of the preceding claims, characterized in

that the coating material is sprayed on first, whereupon the coating material is applied in the form of a strand or strip of material to the edges of the sprayed-on coating material.

14. Process according to Claim 13, characterized in that several swathes of coating material which are essentially parallel to each other are sprayed on by one or more spray nozzles (*2*, *4*).

15. Process according to Claim 13 or Claim 14, characterized in that the spray nozzle (*2*, *4*) and the applicator nozzle (*6*) are moved by a robot arm along preprogrammable paths relative to the surface to be coated.

16. Device for producing a peel-off protective layer for surfaces, especially the painted surfaces of motor vehicle bodies, and especially for implementing the process according to one of the preceding claims, with a spray nozzle (*2*, *4*) which can be supplied with liquid coating material from a coating material source so that a curable liquid coating material can be sprayed onto the surface to be protected, where the spray nozzle (*2*, *4*) and the surface can be moved relative to each other, characterized by at least one applicator nozzle (*6*) for applying a coating material as an essentially continuous strand or strip of material to the surface to be coated.

17. Device according to Claim 16, characterized in that the spray nozzle (*2*, *4*) and the applicator nozzle (*6*) are attached to a common frame (*56*) and can be moved by means of a robot arm relative to the surface to be protected.

18. Device according to Claim 17, characterized in that several applicator nozzles (*6*) and spray nozzles (*2*, *4*) are arranged adjacent to each other on the frame (*56*) and can be mounted various distances away from each other.

19. Device according to Claim 16, characterized in that the spray nozzle (*2*, *4*) and the applicator nozzle (*6*) are fed independently of each other by two separate coating material lines (*38*, *40*).

20. Device according to Claim 19, characterized in that, in each of the

coating material lines (*38, 40*), an automatic pressure controller (*42, 44*) is provided, by means of which the pressure of the coating material in the coating material line (*38, 40*) can be adjusted.

21. Device according to one of Claims 16-20, characterized by a light source for producing a beam of light, by an optical sensor for detecting incident light and for generating an electrical signal as a function of the intensity of the incident light, and by a control unit (*34*) connected to the optical sensor for evaluating the optical signals produced by the sensor for the purpose of monitoring the coating material streams discharged by the applicator nozzle and spray nozzle.

22. Device according to one of the preceding Claims 16-21, characterized by a heating device for tempering the coating material.

KEY: Luftversorgung 6 bar Ölfrei = air supply, 6 bars, oil-free; zu SPS = to the SPC *[Stored Program Control]*; and Erzatzblatt (Regel 26) = replacement page (rule 26).

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(71) Anmelder *(für alle Bestimmungsstaaten mit Ausnahme von US)*: **NORDSON CORPORATION** [US/US]; 28601 Clemens Road, Westlake, OH 44145-1119 (US).

(72) Erfinder; und
(75) Erfinder/Anmelder *(nur für US)*: **ZIMMERMANN, Konrad** [DE/DE]; Schickergasse 5, Altenrath, D-53842 Troisdorf (DE). **REINKE, Klaus, Peter** [DE/DE]; Allenbosteler Weg 4a, D-29574 Ebstorf (DE).

(74) Anwalt: **ANDRES, Mark**; Eisenführ, Speiser & Partner, Martinistrasse 24, D-28195 Bremen (DE).

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Zur Erklärung der Zweibuchstaben-Codes, und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

(54) Title: METHOD AND DEVICE FOR PRODUCING A REMOVABLE PROTECTION LAYER FOR SURFACES, ESPECIALLY VARNISHED SURFACES OF MOTOR VEHICLE BODIES

(54) Bezeichnung: VERFAHREN UND VORRICHTUNG ZUM HERSTELLEN EINER ABZIEHBAREN SCHUTZSCHICHT FÜR OBERFLÄCHEN, INSBESONDERE FÜR LACKIERTE OBERFLÄCHEN VON KRAFTFAHRZEUGKAROSSERIEN

(57) Abstract: The invention relates to a method for producing a removable protection layer for surfaces, especially varnished surfaces of motor vehicle bodies, according to which a liquid thermosetting coating material is sprayed onto the surface to be protected, by means of a spraying nozzle (2, 4), and a hardened protection layer is then obtained on the surface. According to the invention, a substantially continuous string of coating material from an application nozzle (6) is then applied to the surface to be treated, at the edges of the coating material sprayed onto said surface. The invention also relates to a device for implementing said method, which is characterised in that it comprises at least one application nozzle (6) for applying a coating material in the form of a substantially continuous string on the surface to be treated.

(57) Zusammenfassung: Die Erfindung betrifft ein Verfahren zum Herstellen einer abziehbaren Schutzschicht für Oberflächen, insbesondere für lackierte Oberflächen von Kraftfahrzeugkarosserien, bei dem ein flüssiges, aushärtbares Beschichtungsmaterial aus einer Sprühdüse (2, 4) auf die zu schützende Oberfläche aufgesprüht wird und dort eine flächige, aushärtende Schutzschicht bildet. Erfindungsgemäß ist vorgesehen, daß im Randbereich des auf die Oberfläche aufgesprühten Beschichtungsmaterials ein im wesentlichen als kontinuierlicher Materialstrang oder -streifen aus einer Auftragsdüse (6) austretendes Beschichtungsmaterial auf die zu beschichtende Oberfläche aufgebracht wird. Die Erfindung betrifft ferner eine Vorrichtung zum Ausführen dieses Verfahrens und zeichnet sich aus durch mindestens eine Auftragsdüse (6) zum Aufbringen eines Beschichtungsmaterials im wesentlichen als kontinuierlicher Materialstrang oder -streifen auf die zu beschichtende Oberfläche.

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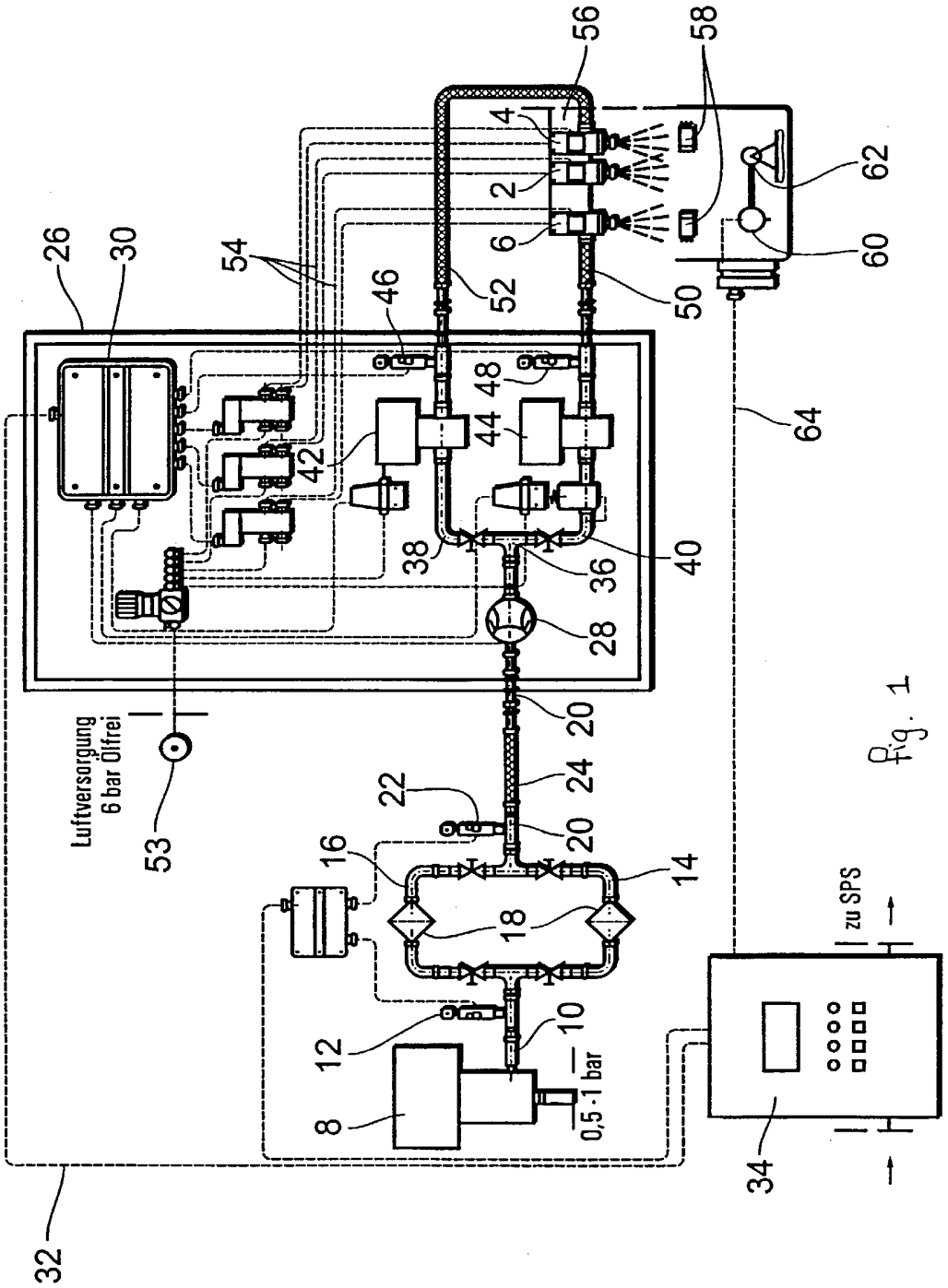
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28
20
Luftversorgung
6 bar Ölfrei
53
22
24
20
16
14
18
zu SPS
12
10
0,5-1 bar
8
34
32

Fig. 1

Declaration and Power of Attorney for Patent Application

Erklärung für Patentanmeldungen mit Vollmacht

German Language Declaration

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt:

daß mein Wohnsitz, meine Postanschrift und meine Staatsangehörigkeit den im nachstehenden nach meinem Namen aufgeführten Angaben entsprechen,

daß ich nach bestem Wissen der ursprüngliche, erste und alleinige Erfinder (falls nachstehend nur ein Name angegeben ist) oder ein ursprünglicher, erster und Miterfinder (falls nachstehend mehrere Namen aufgeführt sind) des Gegenstandes bin, für den dieser Antrag gestellt wird und für den ein Patent für die Erfindung mit dem Titel beantragt wird:

_____

_____

deren Beschreibung hier beigefügt ist, es sei denn (in diesem Falle Zutreffendes bitte ankreuzen), diese Erfindung

☐ wurde eingereicht am _____ unter der U.S. Anmeldenummer oder unter der Internationalen Anmeldenummer im Rahmen des Vertrags über die Zusammenarbeit auf dem Gebiet des Patentwesens (PCT) _____ und am _____ abgeändert (falls zutreffend).

Ich bestätige hiermit, daß ich den Inhalt der oben angegebenen Patentanmeldung, einschließlich der Ansprüche, die eventuell durch einen oben erwähnten Zusatzantrag abgeändert wurde, durchgesehen und verstanden habe.

Ich erkenne meine Pflicht zur Offenbarung jeglicher Informationen an, die zur Prüfung der Patentfähigkeit in Einklang mit Title 37, Code of Federal Regulations, §1.56 von Belang sind.

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled.

METHOD AND DEVICE FOR PRODUCING A REMOVABLE PROTECTING LAYER FOR SURFACES, ESPECIALLY VARNISHED SURFACES OF MOTOR VEHICLE BODIES

the specification of which is attached hereto unless the following box is checked:

☒ was filed on February 7, 2002 as United States Application Number or PCT International Application Number 10/049,165 and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56.

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Ich beanspruche hiermit ausländische Prioritätsvorteile gemäß Title 35, United States Code, § 119 aller unten aufgelisteten Auslandsanmeldungen für Patente oder Erfinderurkunden und habe nachstehend sämtliche Auslandsanmeldungen für Patente oder Erfinderurkunden angegeben, deren Anmeldetag dem der Anmeldung, für welche Priorität beansprucht wird, vorangeht.

I hereby claim foreign priority under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

Prior foreign applications (Anmeldungen ausländischer Prioritäten)		Priority claimed / Priorität beansprucht	
PCT/EP00/05843 (Number) (Nummer)	PCT (Country) (Land)	24/06/2000 (Day/Month/Year Filed) (Tag/Monat/Jahr der Anmeldung)	XX Yes Ja ☐ No Nein
19936790 (Number) (Nummer)	DE (Country) (Land)	10/08/1999 (Day/Month/Year Filed) (Tag/Monat/Jahr der Anmeldung)	XX Yes Ja ☐ No Nein
(Number) (Nummer)	(Country) (Land)	(Day/Month/Year Filed) (Tag/Monat/Jahr der Anmeldung)	☐ Yes Ja ☐ No Nein

Ich erhebe hiermit Anspruch auf die mir unter Title 35, United States Code, §120 zustehenden Vorteile aller untenstehend aufgelisteten U.S. Patentanmeldungen und erkenne, insofern als der Gegenstand eines jeden Anspruchs dieser Patentanmeldung nicht in einer älteren U.S. Patentanmeldung in einer gemäß dem ersten Absatz von Title 35, United States Code, § 112 vorgeschriebenen Art und Weise offenbart wurde, meine Pflicht zur Offenbarung jeglicher Informationen an, die zur Prüfung der Patentfähigkeit in Einklang mit Title 37, Code of Federal Regulations, §1.56 von Belang sind und die im Zeitraum zwischen dem Anmeldetag der älteren Patentanmeldung und dem nationalen oder im Rahmen des Vertrags über die Zusammenarbeit auf dem Gebiet des Patentwesen (PCT) gültigen internationalen Anmeldetags bekannt geworden sind.

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Serial No.) (Anmeldeseriennummer)	(Filing Date) (Anmeldedatum)	(Status) (patentiert, schwebend, aufgegeben)	(Status) (patented, pending, abandoned)
(Application Serial No.) (Anmeldeseriennummer)	(Filing Date) (Anmeldedatum)	(Status) (patentiert, schwebend, aufgegeben)	(Status) (patented, pending, abandoned)

Ich erkläre hiermit, daß alle in der vorliegenden Erklärung von mir gemachten Angaben nach bestem Wissen und Gewissen der Wahrheit entsprechen und daß ich diese eidesstattliche Erklärung in Kenntnis dessen ablege, daß wissentlich und vorsätzlich falsche Angaben oder dergleichen gemäß Paragraph 1001, Title 18 des United States Code strafbar sind und mit Geldstrafe und/oder Gefängnis bestraft werden können und daß derartige wissentlich und vorsätzlich falsche Angaben die Rechtswirksamkeit der vorliegenden Patentanmeldung oder eines darauf erteilten Patentes gefährden können.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application of any patent issued thereon.

German Language Declaration

VERTRETUNGSVOLLMACHT: Als benannter Erfinder beauftrage ich hiermit den (die) nachstehend aufgeführten Patentanwalt (Patentanwälte) und/oder Vertreter mit der Verfolgung der vorliegenden Patentanmeldung sowie mit der Abwicklung aller damit verbundenen Angelegenheiten vor dem U.S. Patentamt und Warenzeichenregister: *(Name(n) und Registrationsnummer(n) auflisten)*

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith *(list name and registration number)*

See Page 4 of 4

Postanschrift:

Send Correspondence to:
KEVIN G. ROONEY
WOOD, HERRON & EVANS, L.L.P.
2700 CAREW TOWER
CINCINNATI, OH 45202

Telefonische Auskünfte:
(Name und Telefonnummer)

Direct Telephone Calls to: (*name and telephone number*)
KEVIN G. ROONEY
(513) 241-2324

Vor- und Zuname des einzigen oder ersten Erfinders:	Full name of sole or first inventor ZIMMERMANN, Konrad
Unterschrift des Erfinders Datum	Inventor's signature Date FEB-22-02
Wohnsitz	Residence Schickergasse 5, Altenrath 53842 Troisdorf, Germany
Staatsangehörigkeit	Citizenship Germany
Postanschrift	Post Office Address Same as above
Vor- und Zuname des zweiten Miterfinders (falls zutreffend)	Full name of second joint inventor, if any REINKE, Klaus Peter
Unterschrift des zweiten Erfinders Datum	Second inventor's signature Date Feb.-20-2002
Wohnsitz	Residence Allenbosteler Weg 4a 29574 Ebstorf, Germany
Staatsangehörigkeit	Citizenship German
Postanschrift	Post Office Address Same as above

(Im Falle dritter und weiterer Miterfinder sind die entsprechenden Informationen und Unterschriften hinzuzufügen.)

(Supply similar information and signature for third and subsequent joint inventors.)

POWER OF ATTORNEY: As named inventor, I hereby appoint I hereby appoint Richard H. Evans (R. No. 19,755), John D. Poffenberger (R. No. 20,245), Bruce Tittel (R. No. 22,324), Donald F. Frei (R. No. 21,190), David J. Josephic (R. No. 22,849), A. Ralph Navaro, Jr. (R. No. 23,050), David S. Stallard (R. No. 25,930), J. Robert Chambers (R. No. 25,448), Gregory J. Lunn (R. No. 29,945), Kurt L. Grossman (R. No. 29,799), Clement H. Luken, Jr. (R. No. 32,742), Thomas J. Burger (R. No. 32,662), Gregory F. Ahrens (R. No. 32,957), Wayne L. Jacobs (R. No. 35,553), Kurt A. Summe (R. No. 36,023), Kevin G. Rooney (R. No. 36,330), Thomas W. Humphrey (R. No. 34,353), Keith R. Haupt (R. No. 37,638), Theodore R. Remaklus (Reg. No. 38,754), Scott A. Stinebruner (R. No. 38,323), Joseph R. Jordan (R. No. 25,686), C. Richard Eby (R. No. 25,854), David E. Pritchard (R. No. 38,273), David H. Brinkman (R. No. 40,532), J. Dwight Poffenberger, Jr. (R. No. 35,324), Beverly A. Lyman, Ph.D. (R. No. 41,963), Kristi L. Davidson (R. No. 44,643), P. Andrew Blatt, Ph.D. (R. No. 44,540), David E. Jefferies (R. No. 46,800), William R. Allen, Ph.D. (R. No. 48,389) and Thomas W. Flynn (R. No. 21,097), in care of Wood, Herron & Evans, L.L.P., 2700 Carew Tower, Cincinnati, Ohio 45202, and telephone number (513) 241-2324, and J. Bradford Leaheey (R. No. 27,107), Edmund J. Wasp (R. No. 29,598) and Raymond J. Slattery III (R. No. 32,108), in care of Nordson Corporation, 28601 Clemens Road, Westlake, Ohio 44145, and telephone number (216) 892-1580, my attorneys with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

33

SUPPLEMENTAL

Declaration and Power of Attorney for Patent Application

Erklärung für Patentanmeldungen mit Vollmacht

German Language Declaration

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deren Beschreibung hier beigefügt ist, es sei denn (in diesem Falle Zutreffendes bitte ankreuzen), diese Erfindung

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☒ was filed on February 7, 2002 as United States Application Number or PCT International Application Number 10/049,165 and was amended on June 6, 2002 (if applicable).

Ich bestätige hiermit, daß ich den Inhalt der oben angegebenen Patentanmeldung, einschließlich der Ansprüche, die eventuell durch einen oben erwähnten Zusatzantrag abgeändert wurde, durchgesehen und verstanden habe.

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		(Day/Month/Year Filed) (Tag/Monat/Jahr der Anmeldung)	☐ Yes Ja	☐ No Nein

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(Application Serial No.) (Anmeldeseriennummer)	(Filing Date) (Anmeldedatum)	(Status) (patentiert, schwebend, aufgegeben)	(Status) (patented, pending, abandoned)
(Application Serial No.) (Anmeldeseriennummer)	(Filing Date) (Anmeldedatum)	(Status) (patentiert, schwebend, aufgegeben)	(Status) (patented, pending, abandoned)

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See Page 4 of 4

Postanschrift:	Send Correspondence to: ~~KEVIN G. ROONEY~~ WOOD, HERRON & EVANS, L.L.P. 2700 CAREW TOWER CINCINNATI, OH 45202
Telefonische Auskünfte: *(Name und Telefonnummer)*	Direct Telephone Calls to: (*name and telephone number*) KEVIN G. ROONEY (513) 241-2324

Vor- und Zuname des einzigen oder ersten Erfinders:	Full name of sole or first inventor ZIMMERMANN, Konrad
Unterschrift des Erfinders Datum	Inventor's signature X 27th Aug 2002 Date
Wohnsitz	Residence Schickergasse 5, Altenrath 53842 Troisdorf, Germany
Staatsangehörigkeit	Citizenship German
Postanschrift	Post Office Address Same as above
Vor- und Zuname des zweiten Miterfinders (falls zutreffend)	Full name of second joint inventor, if any REINKE, Klaus Peter
Unterschrift des zweiten Erfinders Datum 25th Aug 02	Second inventor's signature X Klaus-Peter Reinke Date
Wohnsitz	Residence Allenbosteler Weg 4a 29574 Ebstorf, Germany
Staatsangehörigkeit	Citizenship German
Postanschrift	Post Office Address Same as above

(Im Falle dritter und weiterer Miterfinder sind die entsprechenden Informationen und Unterschriften hinzuzufügen.)

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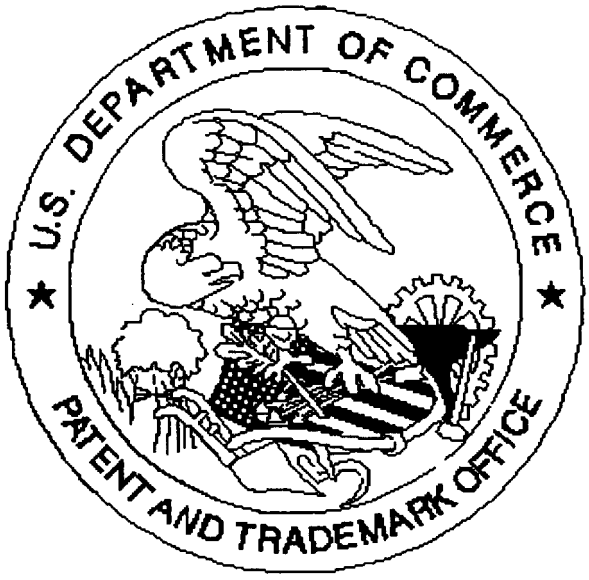

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